

INTEGRATED OPTICAL ISOLATOR ARRAY

ABSTRACT OF THE INVENTION

An integrated isolator array is provided having a plurality of waveguides fabricated in a planar optical substrate, each waveguide having input and output sections. An isolator subassembly is received within a transverse trench formed in the substrate between the input and output sections such that it intersects the optical paths of the waveguides. The isolator subassembly, which may consist of layers of Faraday rotator material sandwiched between layers of birefringent crystal material, permits the forward passage of light from the input sections to the output sections of the waveguides while preventing the backward passage of light from the output to the input sections. Each waveguide input section is preferably adapted with a mode-expanding input taper to collimate light propagating through the waveguide. Similarly, each output section is preferably adapted with a mode-reducing output taper to reduce the mode size of forward-traveling light to match that of an output fiber, as well as to collimate light traveling backward within the output section. In another embodiment of the invention, a circulator array is constructed in a planar substrate by forming a plurality of waveguide pair structures, each waveguide pair structure having first and second sections respectively coupled by first and second polarization multiplexers. A nonreciprocal subassembly is positioned in the optical paths of the waveguide pair structures and is configured to rotate the polarization of light passing from the second sections of the waveguides to the first sections while leaving unchanged the polarization of light passing from the first sections to the second sections. The polarization multiplexers and nonreciprocal subassembly collectively function to route a first light signal input to a port of the first section of the first waveguide to be output at a port of the second section of the first waveguide, a second light signal input at a port of the second section of the first waveguide to be output at a port of the first section of the second waveguide, and so on. In a further embodiment of the invention, a circulator array of the

type described above is utilized as a component of a reflective doped fiber amplifier array.